Title: Logarithmic Transformer And Method Of Logarithmic Transformation
Inventor: Yuji Yamamoto
Application No. New appl.
Docket No. 107156-00194

FIG.1 A

PRIOR ART

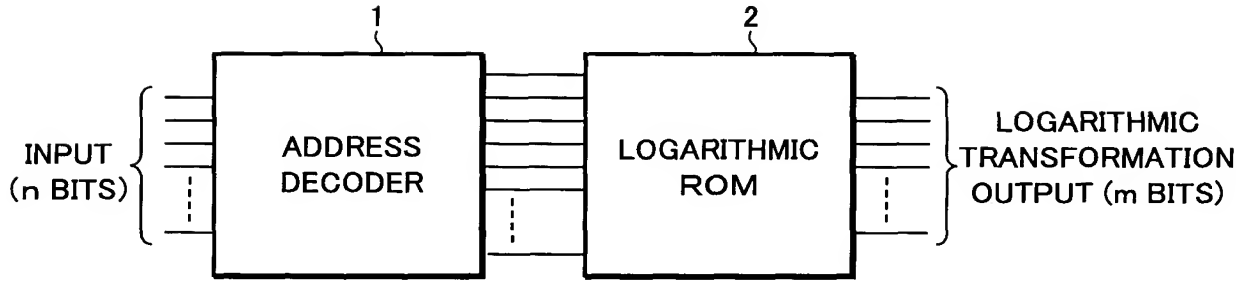

FIG.1 B

PRIOR ART

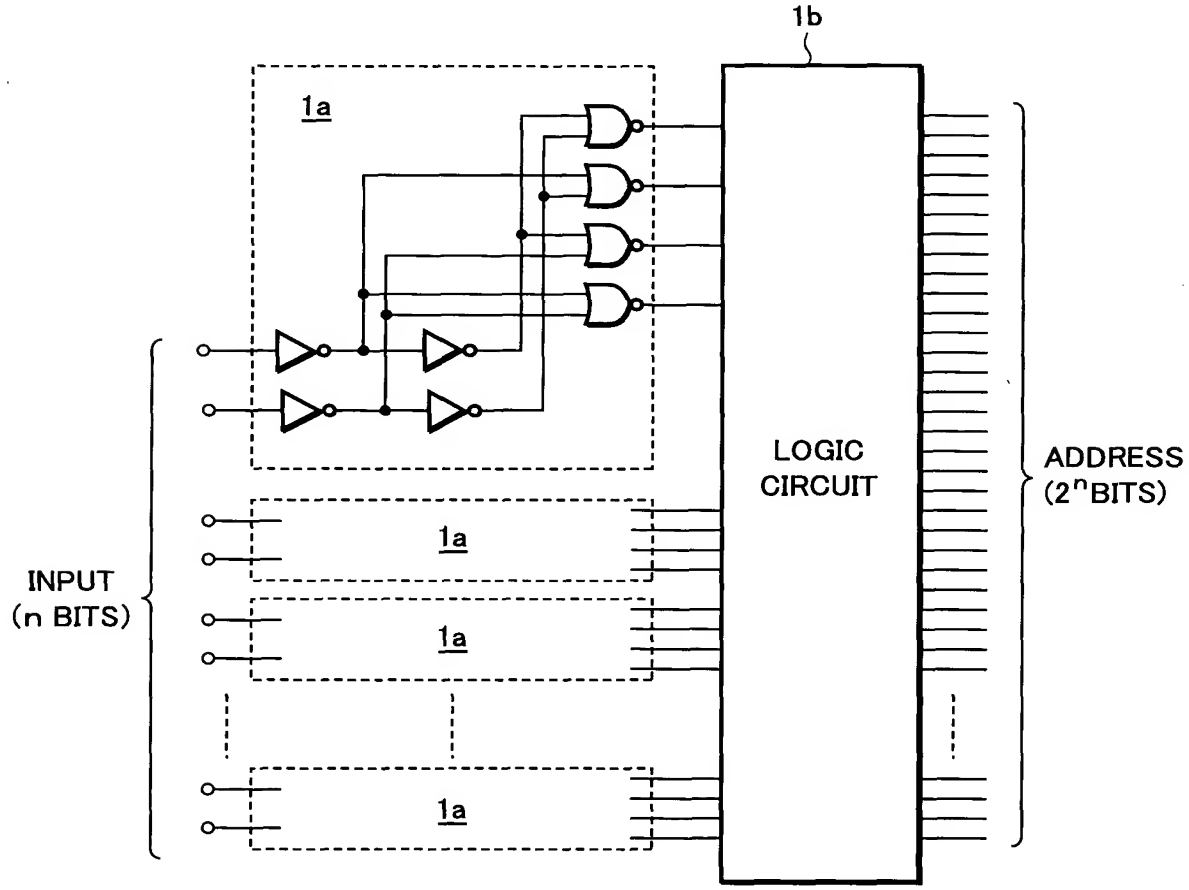

FIG.2

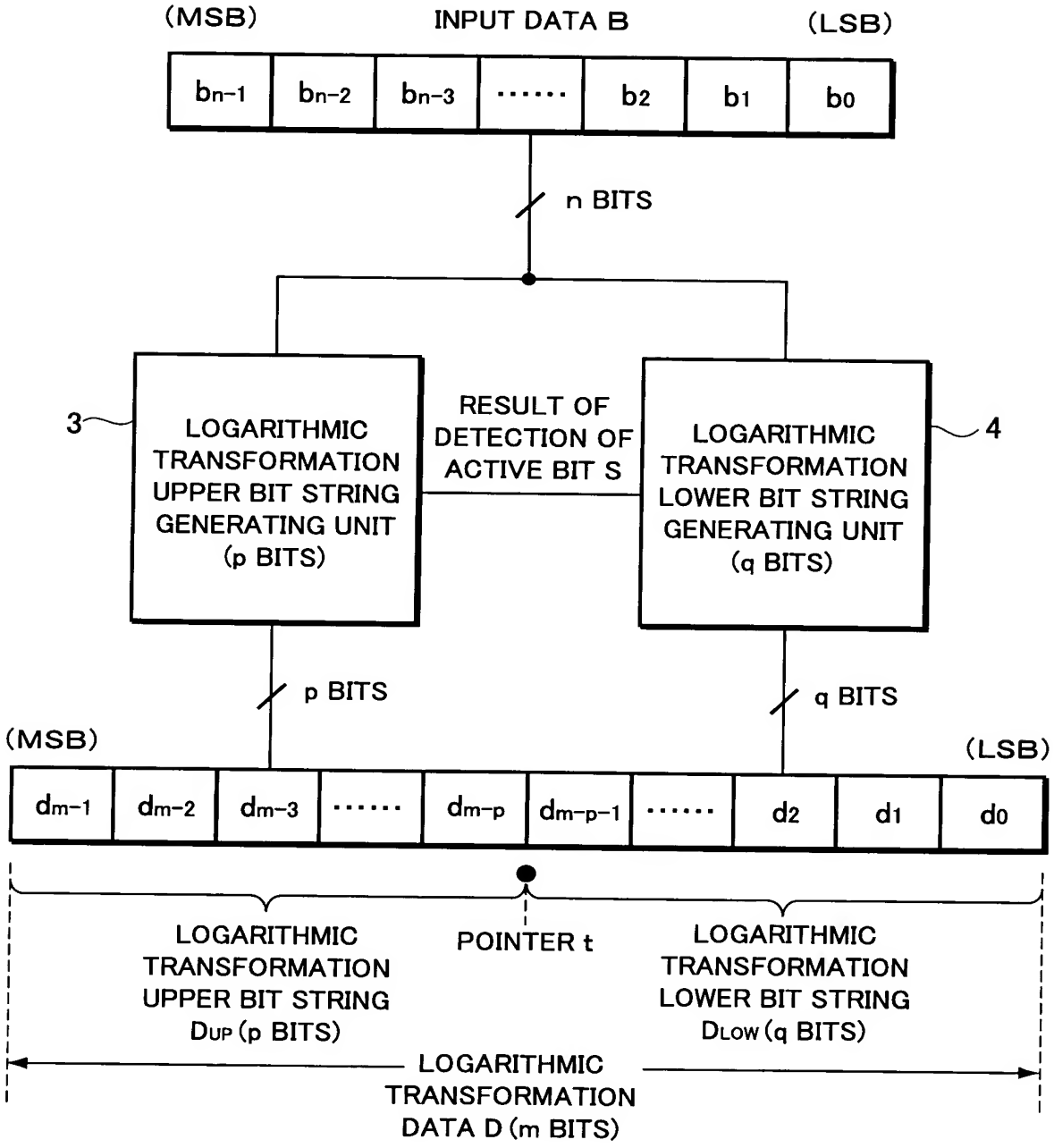
(MSB)
INPUT DATA B
(LSB)
bn-1
bn-2
bn-3
.....
b2
b1
b0
n BITS
3
LOGARITHMIC TRANSFORMATION UPPER BIT STRING GENERATING UNIT (p BITS)
RESULT OF DETECTION OF ACTIVE BIT S
LOGARITHMIC TRANSFORMATION LOWER BIT STRING GENERATING UNIT (q BITS)
4
p BITS
q BITS
(MSB)
(LSB)
dm-1
dm-2
dm-3
.....
dm-p
dm-p-1
.....
d2
d1
d0
LOGARITHMIC TRANSFORMATION UPPER BIT STRING DUP (p BITS)
POINTER t
LOGARITHMIC TRANSFORMATION LOWER BIT STRING DLOW (q BITS)
LOGARITHMIC TRANSFORMATION DATA D (m BITS)

FIG.3

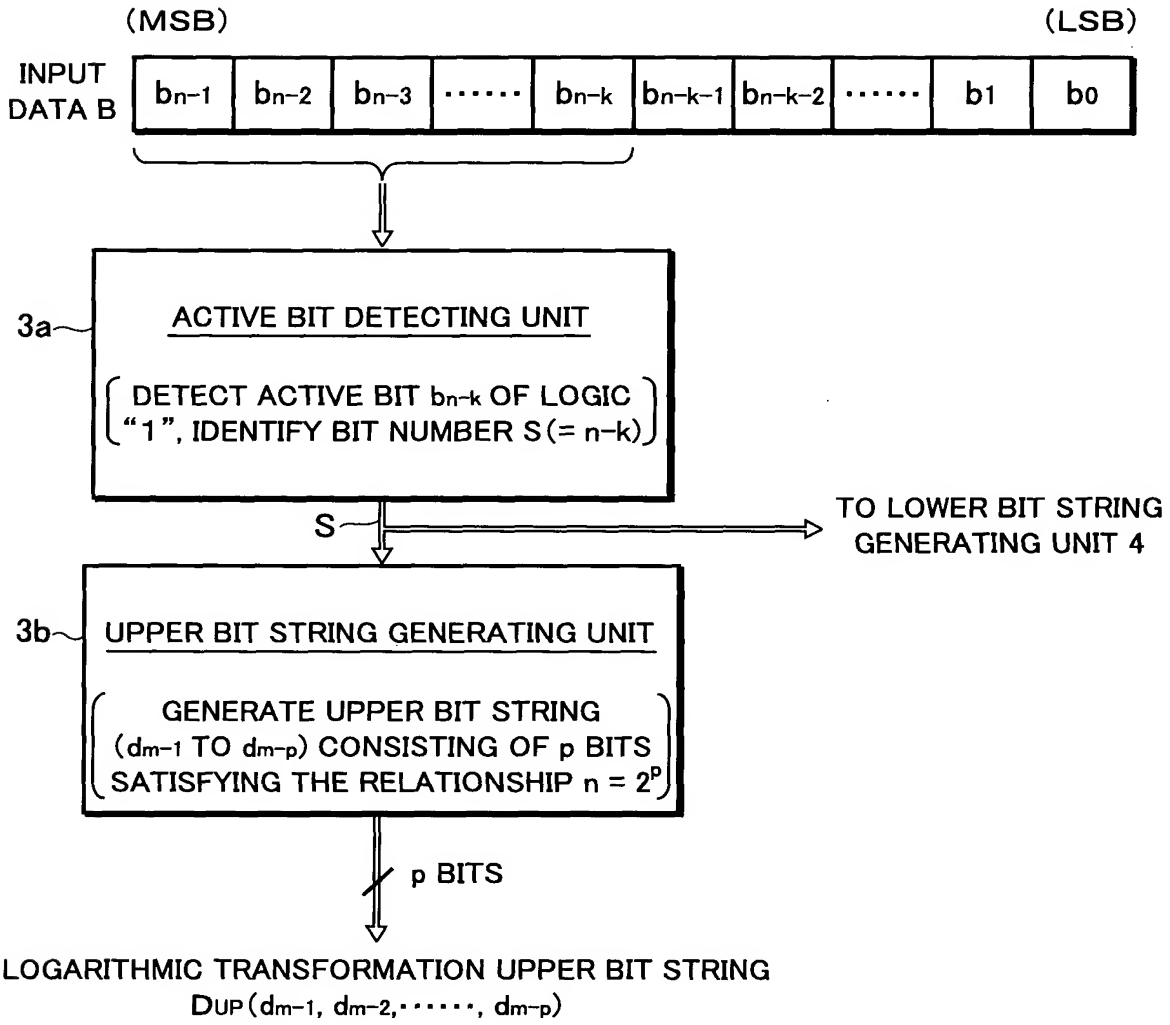
(MSB)
(LSB)
INPUT DATA B
bn-1
bn-2
bn-3
bn-k
bn-k-1
bn-k-2
b1
b0
3a
ACTIVE BIT DETECTING UNIT
DETECT ACTIVE BIT bn-k OF LOGIC "1", IDENTIFY BIT NUMBER S (= n-k)
S
TO LOWER BIT STRING GENERATING UNIT 4
3b
UPPER BIT STRING GENERATING UNIT
GENERATE UPPER BIT STRING (dm-1 TO dm-p) CONSISTING OF p BITS SATISFYING THE RELATIONSHIP n = 2^p
p BITS
LOGARITHMIC TRANSFORMATION UPPER BIT STRING
DUP (dm-1, dm-2, ·····, dm-p)

FIG.4

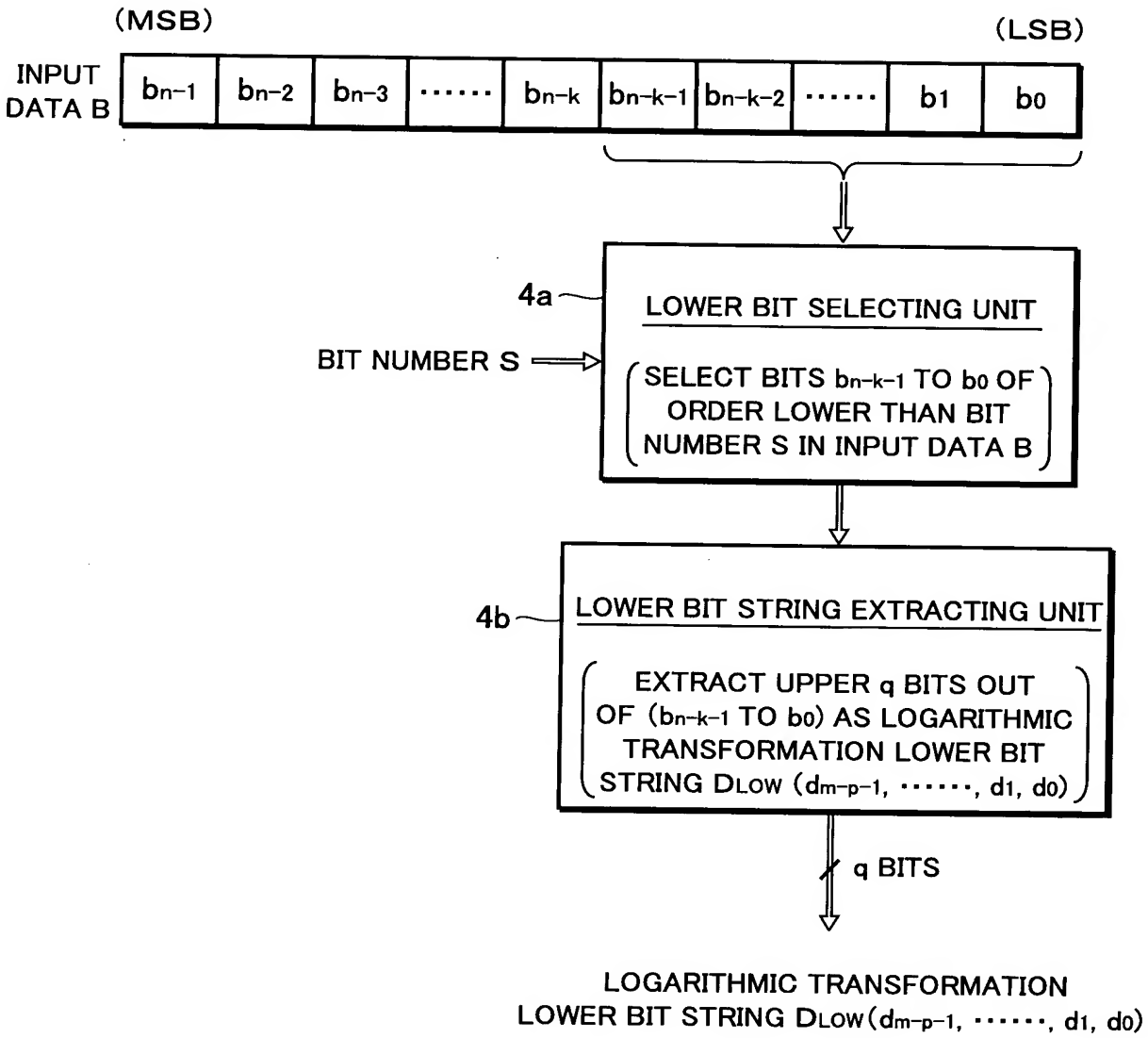
(MSB)
(LSB)
INPUT DATA B
bn-1
bn-2
bn-3
bn-k
bn-k-1
bn-k-2
b1
b0
4a
LOWER BIT SELECTING UNIT
BIT NUMBER S
SELECT BITS bn-k-1 TO b0 OF ORDER LOWER THAN BIT NUMBER S IN INPUT DATA B
4b
LOWER BIT STRING EXTRACTING UNIT
EXTRACT UPPER q BITS OUT OF (bn-k-1 TO b0) AS LOGARITHMIC TRANSFORMATION LOWER BIT STRING DLOW (dm-p-1, ·····, d1, d0)
q BITS
LOGARITHMIC TRANSFORMATION LOWER BIT STRING DLOW(dm-p-1, ·····, d1, d0)

FIG.5

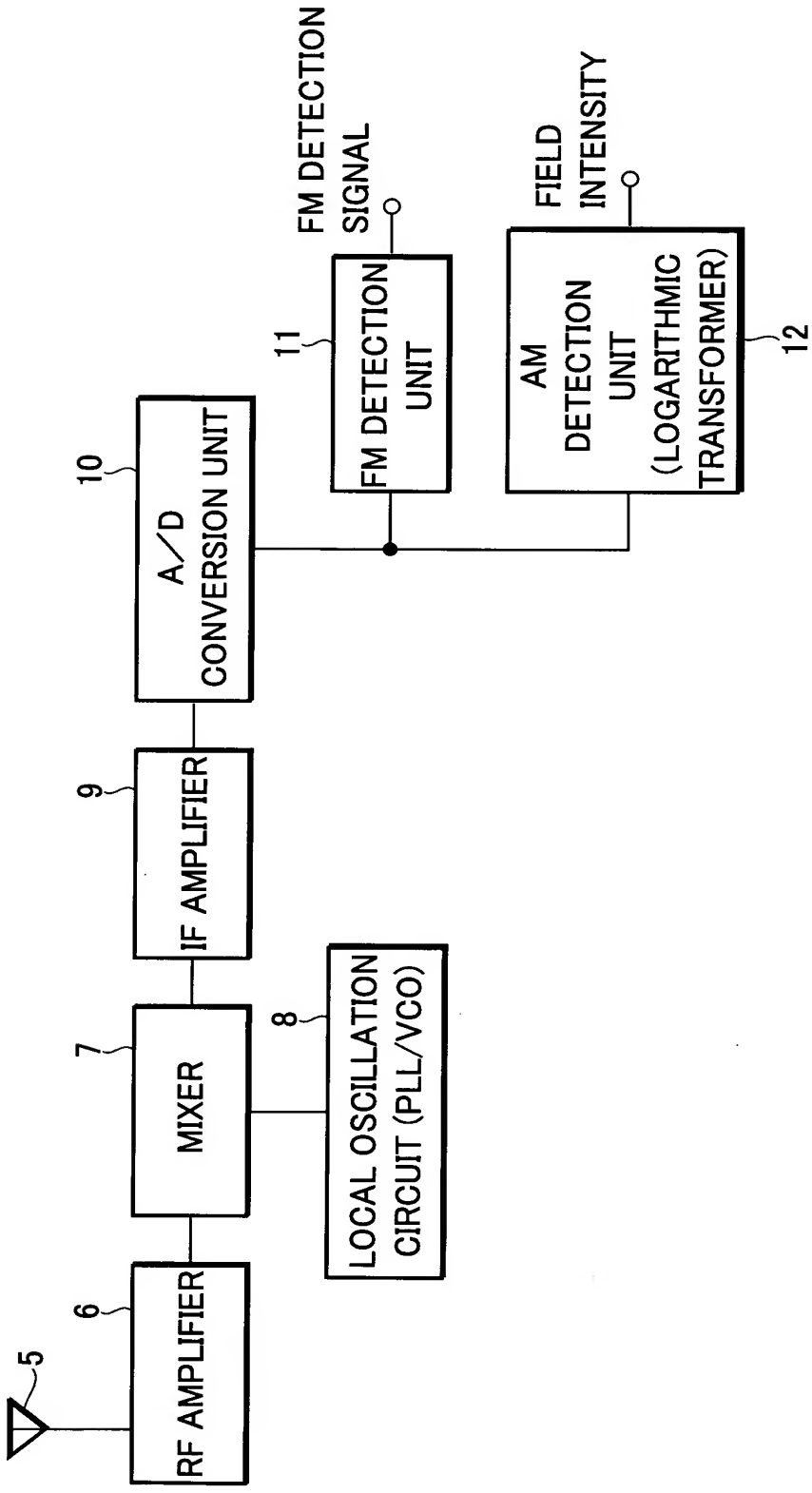
5
RF AMPLIFIER
6
MIXER
7
LOCAL OSCILLATION CIRCUIT (PLL/VCO)
8
IF AMPLIFIER
9
A/D CONVERSION UNIT
10
FM DETECTION UNIT
11
AM DETECTION UNIT (LOGARITHMIC TRANSFORMER)
12
FM DETECTION SIGNAL
FIELD INTENSITY

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FIG.6

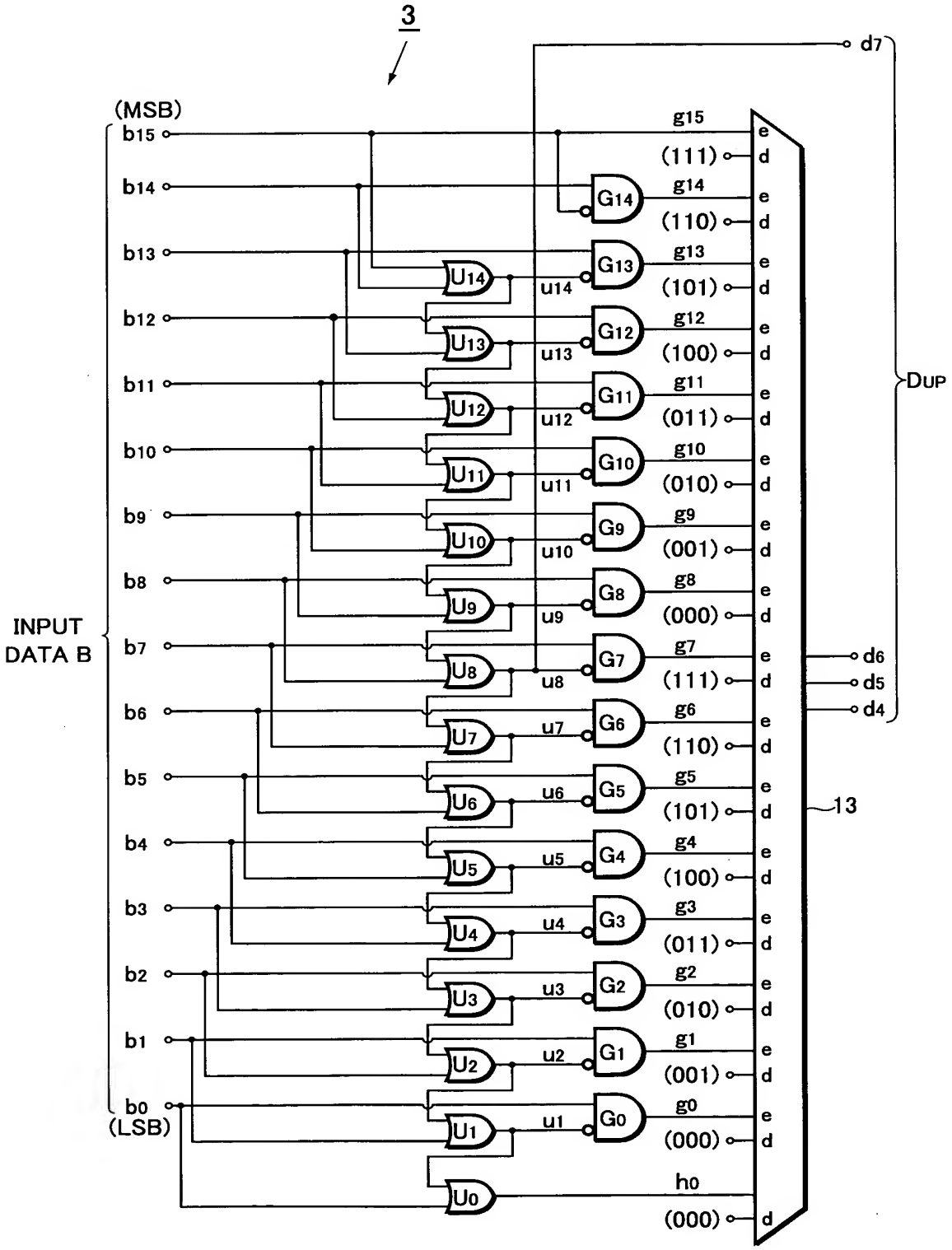


FIG.7

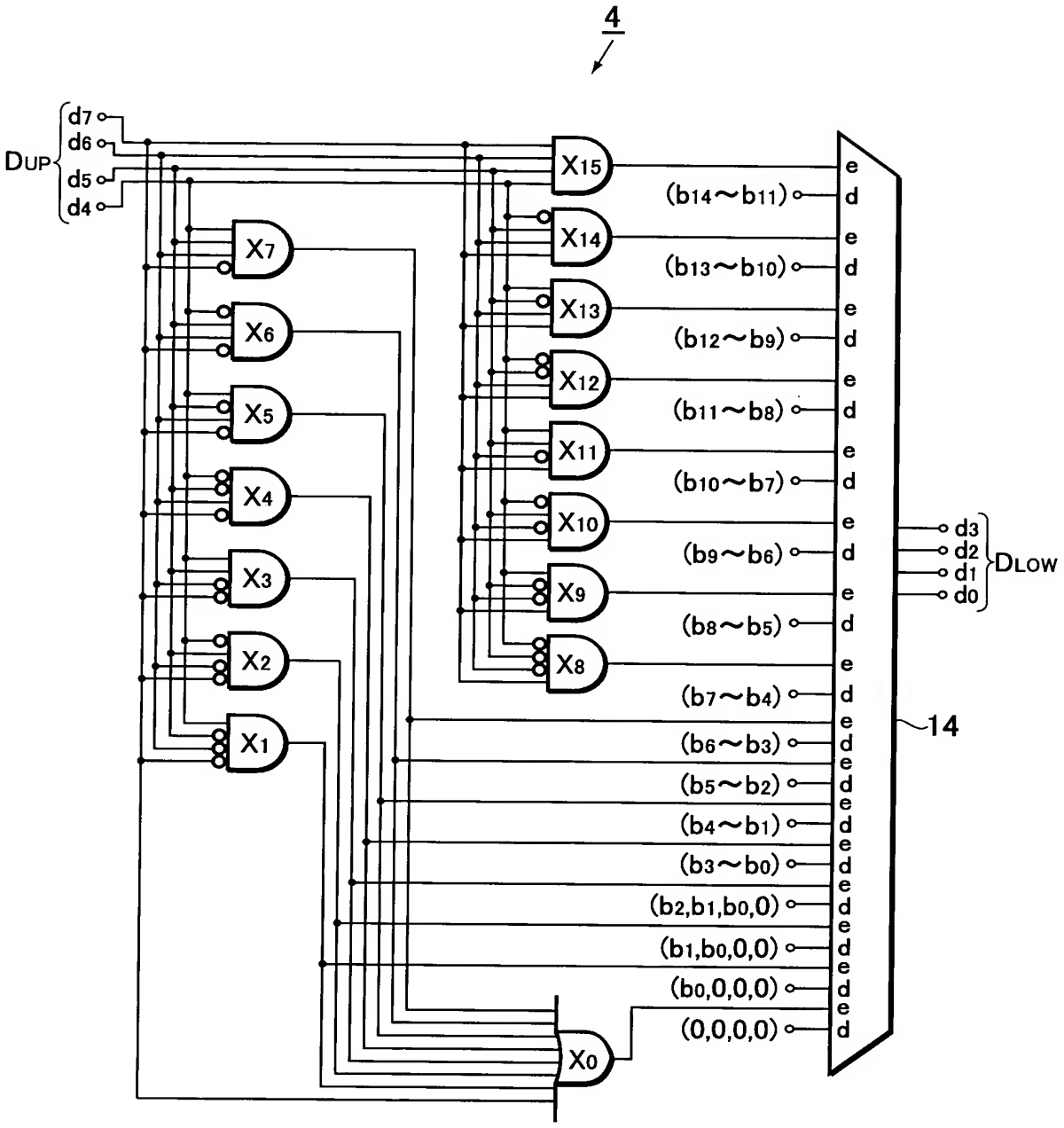

4
DUP
d7
d6
d5
d4
X15
X14
X13
X12
X11
X10
X9
X8
X7
X6
X5
X4
X3
X2
X1
X0
(b14~b11)
(b13~b10)
(b12~b9)
(b11~b8)
(b10~b7)
(b9~b6)
(b8~b5)
(b7~b4)
(b6~b3)
(b5~b2)
(b4~b1)
(b3~b0)
(b2,b1,b0,0)
(b1,b0,0,0)
(b0,0,0,0)
(0,0,0,0)
e
d
14
d3
d2
d1
d0
DLOW

FIG.8

INPUT (IN 16 BITS)																	LOGARITHMIC TRANSFORMATION UPPER BIT STRING DUP(DECIMAL)
DECIMAL	BINARY (MSB)															(LSB)	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	
8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	
10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	
12	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	
14	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	
16	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
32	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5
64	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	6
128	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7
256	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	8
512	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9
1024	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	10
2048	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	11
4096	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	12
8192	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	13
16384	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
32768	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
65535	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

FIG.9

INPUT (IN 16 BITS)		LOGARITHMIC TRANSFORMATION UPPER BIT STRING DUP (DECIMAL)
DECIMAL	BINARY (MSB) (LSB)	
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	0
2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 *	1
4	0 0 0 0 0 0 0 0 0 0 0 0 0 1 * *	2
8	0 0 0 0 0 0 0 0 0 0 0 0 1 * * *	3
16	0 0 0 0 0 0 0 0 0 0 0 1 * * * *	4
32	0 0 0 0 0 0 0 0 0 0 1 * * * * *	5
64	0 0 0 0 0 0 0 0 0 1 * * * * * *	6
128	0 0 0 0 0 0 0 0 1 * * * * * * *	7
256	0 0 0 0 0 0 0 1 * * * * * * * *	8
512	0 0 0 0 0 0 1 * * * * * * * * *	9
1024	0 0 0 0 0 1 * * * * * * * * * *	10
2048	0 0 0 0 1 * * * * * * * * * * *	11
4096	0 0 0 1 * * * * * * * * * * * *	12
8192	0 0 1 * * * * * * * * * * * * *	13
16384	0 1 * * * * * * * * * * * * * *	14
32768	1 * * * * * * * * * * * * * * *	15

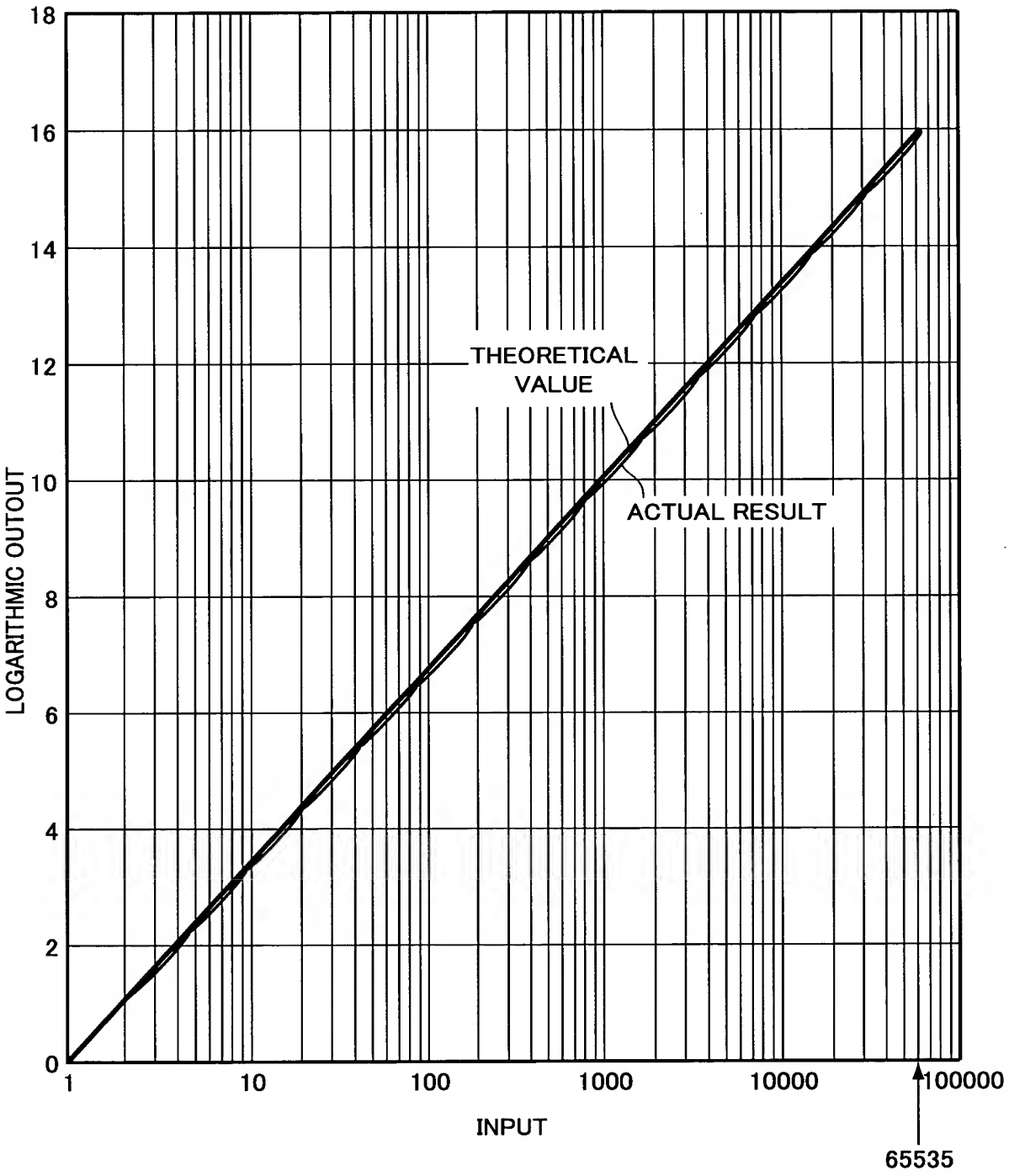
FIG.10

INPUT (IN 16 BITS)		LOGARITHMIC TRANSFORMATION UPPER BIT STRING DUP (DECIMAL)
DECIMAL	BINARY (MSB) (LSB)	
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	0
2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 · *	1
4	0 0 0 0 0 0 0 0 0 0 0 0 0 1 · * *	2
8	0 0 0 0 0 0 0 0 0 0 0 0 1 · * * *	3
16	0 0 0 0 0 0 0 0 0 0 0 1 · * * * *	4
32	0 0 0 0 0 0 0 0 0 0 1 · * * * * *	5
64	0 0 0 0 0 0 0 0 0 1 · * * * * * *	6
128	0 0 0 0 0 0 0 0 1 · * * * * * * *	7
256	0 0 0 0 0 0 0 1 · * * * * * * * *	8
512	0 0 0 0 0 0 1 · * * * * * * * * *	9
1024	0 0 0 0 0 1 · * * * * * * * * * *	10
2048	0 0 0 0 1 · * * * * * * * * * * *	11
4096	0 0 0 1 · * * * * * * * * * * * *	12
8192	0 0 1 · * * * * * * * * * * * * *	13
16384	0 1 · * * * * * * * * * * * * * *	14
32768	1 · * * * * * * * * * * * * * * *	15

FIG.11

INPUT (IN 16 BITS)		LOGARITHMIC TRANSFORMATION DATA D ($\log_2$ B) (DECIMAL)
DECIMAL	BINARY (MSB) (LSB)	
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 [1]	0. 0000
2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 0	1. 0000
3	0 0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 1	1. 5000
4	0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 0	2. 0000
5	0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 1	2. 2500
6	0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 0	2. 5000
7	0 0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 1	3. 0000
8	0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 0 0	3. 1250
9	0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 0 1	3. 2500
10	0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 1 0	3. 3750
11	0 0 0 0 0 0 0 0 0 0 0 0 [1] 0 1 1	3. 5000
12	0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 0 0	3. 6250
13	0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 0 1	3. 7500
14	0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 1 0	3. 8750
15	0 0 0 0 0 0 0 0 0 0 0 0 [1] 1 1 1	3. 5000
16	0 0 0 0 0 0 0 0 0 0 0 [1] 0 0 0 0	4. 0000
32	0 0 0 0 0 0 0 0 0 0 [1] 0 0 0 0 0	5. 0000
64	0 0 0 0 0 0 0 0 0 [1] 0 0 0 0 0 0	6. 0000
128	0 0 0 0 0 0 0 0 [1] 0 0 0 0 0 0 0	7. 0000
256	0 0 0 0 0 0 0 [1] 0 0 0 0 0 0 0 0	8. 0000
512	0 0 0 0 0 0 [1] 0 0 0 0 0 0 0 0 0	9. 0000
1024	0 0 0 0 0 [1] 0 0 0 0 0 0 0 0 0 0	10. 0000
2048	0 0 0 0 [1] 0 0 0 0 0 0 0 0 0 0 0	11. 0000
4096	0 0 0 [1] 0 0 0 0 0 0 0 0 0 0 0 0	12. 0000
8192	0 0 [1] 0 0 0 0 0 0 0 0 0 0 0 0 0	13. 0000
16384	0 [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0	14. 0000
32768	[1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15. 0000
36864	[1] 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0	15. 1250
40960	[1] 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	15. 2500
45056	[1] 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0	15. 3750
49152	[1] 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15. 5000
53248	[1] 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0	15. 6250
57344	[1] 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	15. 7500
61440	[1] 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0	15. 8750

FIG.12


18
16
14
12
10
8
6
4
2
0
LOGARITHMIC OUTOUT
THEORETICAL VALUE
ACTUAL RESULT
1
10
100
1000
10000
100000
INPUT
65535